REMARKS

Claims 1, 5-8, 12, 17, 20, 29, 30, 32, 34, 35, 37-39, 41, 43-59 and 61-76 are pending in this application. Claims 1, 5, 7, 8, 12, 17, 20, 30, 32, 34, 35, 37, 39, 41, 43-48, 50-52, and 54-56 have been amended to expedite prosecution. Claims 3-4, 9-11, 14-16, 18, 19, 21, 22, 31, 33, 36, 40, 42, and 60 have been cancelled by this Amendment C, and claims 61-76 have been added. Applicant reserves the right to reintroduce claims of comparable scope to the original claims in a continuation or other related application.

The Examiner objected to the Abstract of the Disclosure. Since, after amendments, all of the independent claims of the present application are now directed to a force feedback embodiment, Applicant has deleted the previous abstract and has added a new abstract as provided above. Applicant respectfully requests that the objection to the Abstract be withdrawn.

Applicant has made minor grammatical corrections to the specification. In addition, Applicant has amended the title and specification to emphasize the force feedback feature of the present invention that is present in the claims. The previous title has been deleted and a new title has been provided to more appropriately describe the invention recited in the claims. Applicant has simlarly amended the specification to emphasize the force feedback element of the claims. More specifically, Applicant has added a paragraph to the summary on page 3 which includes the language of the detailed description on page 11, lines 17-20, and on page 13, lines 13-25. Applicant has also added a paragraph to the beginning of the detailed description at page 5. This new paragraph includes the language from lines 13-22 on page 13 and refers to this page 13 description. The new paragraphs therefore include description that was present in the original filing of the application and are not new matter.

The Examiner objected to claims 15-22 and 30-32 as being dependent directly or indirectly upon cancelled claims. Applicant has amended the claims accordingly, and respectfully requests that this objection be withdrawn.

The Examiner rejected claims 1, 3-10, 12, 14-21, and 29-33 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Applicant has amended independent claims 1 and 12 to remove the language defining the axes, and respectfully requests that the rejection under §112, second paragraph, be withdrawn.

§103 Rejections

The Examiner rejected claims 1, 3-10, 12, 14-21, and 29-34 under 35 U.S.C. §103 as being unpatentable over Hara (U.S. Patent 5,379,663) and Davies (U.S. Patent No. 4,593,470). Applicant respectfully traverses. Hara discloses a joystick device that can be moved in up to six degrees of freedom and is used for controlling a device or object such as a manipulator (col. 1, lines 12-14). Davies discloses a graphics tablet having an articulated arm and a tip element for providing three-dimensional, spatial (x, y, z) coordinates of the location of the tip element in a defined volume to a computer.

In contrast, claim 1 recites a stylus coupled to a mechanical linkage and a sensor for producing a stylus locative signal indicating the orientation, location or movement of the stylus and which is used by the host computer to manipulate images on a display screen using the stylus locative signal. The images include a cursor having a position on the screen that is controlled by the stylus locative signal, as disclosed on page 13, lines 13-25 of Applicant's specification. Applicant's invention thus provides a versatile interface between a user handling a stylus and images displayed by the controlling computer apparatus. These features are neither disclosed nor reasonably suggested by Hara and Davies. Hara discloses a joystick handle device which is grasped by a user and is oriented to be used while the user is sitting in a chair. The user is intended to control a device such as a robotic manipulator (col. 1, lines 12-14), not images displayed on a computer apparatus. Likewise, Davies discloses a stylus element for tracing 3-D objects and inputting the object's coordinates into a computer. Only x, y and z coordinates are input to the host computer in Davies to represent a model that has been traced by the stylus. Davies does not use a stylus as an interface to manipulate images, such as a cursor, displayed by a computer. Thus, there is no suggestion in either Hara or Davies for producing a locative signal that provides the orientation, location, or movement of the stylus to a computer, which displays images such as a cursor whose position is controlled by the stylus locative signal.

In addition, claim 1 has been amended to incorporate subject matter of dependent claim 11 and recites a force generator for generating a force on the stylus in at least one of the five of degrees of freedom. The force is generated in response to force signals provided to the interactive device which are correlated to information displayed on the computer display screen. As stated by the Examiner in the second §103 rejection (point 7) of the Office Action, the combination of Hara and Davies fails to teach the concept of integrating force feedback in the stylus position detection system. In that rejection, the Examiner stated that it would have been obvious to one of ordinary skill in the art to include a means for providing feedback to the user, and cites the Fischer article as an example. However, Applicant believes that it would not be obvious to add a such a force feedback system to the interactive device recited in claim 1. The prior art discloses force feedback gloves for interacting with virtual environments, which are "floating" devices that are freely moved when worn by a user. None of the prior art references discloses using a stylus and a

mechanical linkage attached to a fixed support in which force feedback is applied. There is no teaching or suggestion of utilizing force feedback with the stylus of Davies, since the Davies stylus is only used to input coordinates; force feedback is useless and would be a detriment to the desired free movement of the stylus in the Davies embodiment. Hara also does not disclose or suggest including force feedback in his manipulator device. Applicant therefore believes that claim 1 is patentable over Hara in combination with Davies and the Fischer article.

Claims 5-8 are dependent from claim 1 and are patentable over the cited references for at least the same reasons as recited with respect to claim 1. Claim 7 additionally recites that the configuration of joints on the mechanical linkage allows the stylus to spin freely about an axis extending through the length of the stylus while the other joints remain fixed in position. This spin motion, for example, is disclosed as degree of freedom 6 in Figure 8 of Applicant's specification. Motion in this degree of freedom is not used, and is not useful, to the embodiment disclosed by Davies. In Davies, the x, y, and z coordinates of a model are input to a computer, and the spin of the stylus does not provide any additional information when sensing these spatial coordinates. Applicant's claim 1, however, includes this motion to change the orientation of the stylus and includes a sensor to provide a stylus locative signal that describes the spin movement to the host computer. This spin movement can be useful when controlling the position of images, such as a cursor, displayed on a display screen. None of the references cited by the Examiner disclose or suggest a stylus with a spin type of motion.

Claim 8 additionally recites that the three joints closest to the stylus control the orientation of the stylus, where the orientation is variable by a user while a position of a point on the stylus remains fixed. For example, a point on the tip of the stylus can remained fixed at a single x, y, and z spatial point while the length of the stylus behind the tip is rotated or moved to change its orientation; this is possible due to the configuration of joints disclosed by Applicant. Such orientation movement is not disclosed or suggested by Davies, since moving the orientation of the stylus is useless to Davies' spatial coordinate input method. Hara also does not disclose such movement.

Claim 12 recites a method similar to the device of claim 1, including a cursor displayed by a computer display apparatus and a feedback means for generating force on the stylus. Claim 12 is therefore patentable over the cited art for similar reasons explained with reference to claim 1. Claims 17, 20, 30, and 32 are dependent from claim 12 and are patentable over the cited references for at least the same reasons as claim 12.

Applicant therefore believes that claims 1, 5-8, 12, 17, 20, 29, 30, 32, and 34 are patentable over the cited art, and respectfully requests that the rejection under § 103 be withdrawn.

The Examiner rejected claims 11, 22, and 35-60 under 35 U.S.C. §103 as being unpatentable over Hara in view of Davies and Fischer et al. Claims 11 and 22 have been cancelled. Claim 35 recites an interactive device similar to that of claims 1 and 5. The force signal in claim 35 is output to the feedback device when the computer cursor interacts with other images displayed on the computer display apparatus. For example, a cursor moving into a surface generated on a computer screen can be sensed and forces provided on the stylus accordingly, as disclosed in Applicant's specification on page 13, lines 13-25 and recited in dependent claim 37. The features of a stylus controlling a cursor on a screen and providing force feedback in accordance with interaction of displayed images are not disclosed or suggested in any of the references of Hara, Davies, or Fischer et al. Claims 37 and 38 are dependent on claim 35 and are thus patentable over the cited references for at least the same reasons as claim 35.

Claim 39 recites a system for controlling an interface apparatus that includes a host computer system, a microprocessor separate from the host computer system, an actuator for providing a force along a degree of freedom of a physical object, a sensor for detecting motion of the physical object, a memory, program instructions stored in the memory, and command routines stored in the memory. Applicant's claim recites a microprocessor separate from the host computer system that receives commands from the host and controls an actuator to provide forces on the physical object. The microprocessor also receives a locative signal from the sensor and sends a microprocessor input control signal, derived from the locative signal at least in part, to the host computer. None of the cited references disclose a separate microprocessor that acts as an intermediary between a host computer system and an actuator or sensor. The Davies patent discloses providing coordinate data directly from potentiometers (sensors) to a host computer (col. 3, lines 47-50) or to an analog to digital converter between the potentiometer and host computer, but does not disclose providing a microprocessor to interface the potentiometers and host computer. The Hara patent discloses outputting signals to a controlled device such as a manipulator, not to a separate microprocessor. The Fischer reference does not disclose any circuitry at all, let alone a separate microprocessor as in Applicant's claim 39.

In addition, claim 39 recites that local memory is provided separate from memory of the host computer and comprises non-volatile memory. An example of such memory is disclosed on page 8, lines 24-26 of Applicant's specification as a ROM memory device. Program instructions stored in the memory enables communication and allows the microprocessor to decode commands. Command routines in the memory control the actuator in accordance with host commands. Neither Hara nor Davies disclose force feedback, and thus do not disclose such program instructions nor routines used with host commands. Fischer also does not disclose or suggest providing commands to exert forces nor controlling forces and input using such program instructions and routines. Applicant therefore believes that claim 39 is patentable over the Hara, Davies, and Fischer references.

Claims 41 and 43-47 are dependent from claim 39 and are patentable over the cited references for at least the same reasons as claim 39. In addition, claim 45 recites that a serial

interface is provided between the microprocessor and host computer system, as disclosed in Figure 2A of Applicant's specification. None of the cited references disclose or suggest providing a serial interface to a separate microprocessor used for force feedback operation. Applicant's separate microprocessor, in fact, allows a relatively slow serial interface to be feasible for force feedback applications, since, for example, the microprocessor can directly control the actuator at the necessary high speeds while the commands from the host computer can be provided serially to the microprocessor at a slower rate. Applicant therefore believes claims 39, 41 and 43-47 are patentable over Hara in view of Davies and Fischer et al.

Claim 48 recites a method for interfacing motion of an object with a host computer system which includes steps similar to elements of the system of Figure 39. A separate microprocessor is used to receive signals from a sensor and send the sensor signals to the host computer, as well as receive host commands used to control an actuator. A memory device stores program instructions to enable communication and actuator control. As explained with reference to claim 39, these features are patentable over the cited art. Claims 49-53 are dependent from claim 48 and are patentable over the cited art for at least the same reasons as claim 48. Claim 49 recites a serial interface similar to claim 45 and is similarly patentable.

Claim 54 recites an interface device communicating with a host computer system displaying visual images on a screen. The recited elements in claim 54 are similar to elements of claim 39, described above, in which a microprocessor provides commands to an actuator based on host commands. None of the cited references disclose using host commands or force commands with a microprocessor, and claim 54 is thus believed patentable over Hara, Davies, and Fischer et al. Claims 55-59 are dependent on claim 54 and are patentable over the cited references for at least the same reasons as claim 54. Claim 56 additionally recites that the microprocessor receives sensor information in accordance with a processor routine selected by the host command. This is disclosed in Applicant's specification on page 10, lines 19-26 and is not disclosed or suggested by the art cited by the Examiner.

Claims 61-76 have been added by this amendment. Claim 61 is dependent from claim 1 and recites that a button on the stylus is used to send a command signal to the host computer, as disclosed on page 7, lines 30-32. Claims 62-64 depend from claim 39. Claim 63 recites that the program instructions include command routines that are executed when instructed by the host commands, an example of which is disclosed on page 10, lines 19-32 and page 11 lines 1-20. Claim 64 recites that the state of the peripheral switch is reported and controlled by one or more command routines. Claims 65 and 66 depend from claim 48 and recite similar subject matter. Claims 67-72 depend from claim 54. Claim 67 recites that the microprocessor is provided on board the interface device, as disclosed on page 9, lines 25-29. Claim 68 recites that the microprocessor monitors and decodes the host commands, and that multiple available routines can be called by the microprocessor in accordance with the host command, as disclosed on page 10, lines 19-32 and page 11 lines 1-20. Claim 69 recites executing code to report the state of a peripheral switch, claim 70 recites setting communication parameters using a routine, claim 71

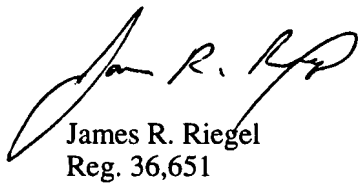
recites reporting sensor readings using a routine, and claim 72 recites setting a force on a joint using a routine; these features are disclosed on pages 10 and 11. None of these features are disclosed or suggested by the cited references, which do not make mention of a separate microprocessor, routines used by such a microprocessor, or the actions controlled by the routines.

New claim 73 recites an interface apparatus having substantially similar elements as claim 39, and is patentable over the cited references for reasons similar to those described for claim 39. Claims 74-76 are dependent from claim 73 and recite additionally-patentable subject matter disclosed in Applicant's specification on page 12, lines 10-12 (claim 74), page 10, lines 27-32 (claim 75) and page 12, lines 26-32 (claim 76).

Applicant believes that claims 35, 37-39, 41, 43-59, and 61-76 are patentable over Hara in view of Davies and Fischer et al., and respectfully requests that the rejection under § 103 be withdrawn.

In view of the foregoing, Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,



James R. Riegel
Reg. 36,651

Palo Alto, California
415-493-6400